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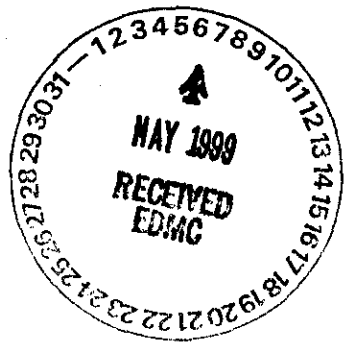
DEPARTMENT OF ENERGY



Record of Decision: Management of Spent Nuclear Fuel From the K Basins at the Hanford Site, Richland, WA

AGENCY: U.S. Department of Energy (DOE).

ACTION: Notice of Record of Decision (ROD).

SUMMARY: DOE has prepared and issued a final environmental impact statement (FEIS) on the ``Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington'' (DOE/EIS-0245F, January 1996). A notice of availability of the FEIS was published in the Federal Register on February 2, 1996 (61 FR 3932). The FEIS evaluates the potential environmental impacts of alternatives for managing the spent nuclear fuel (SNF) located in the K-East (KE) and K-West (KW) SNF storage basins at the Hanford Site located in southeastern Washington State.

Based on the analysis in the FEIS and after careful evaluation of environmental impacts, costs, compliance requirements, engineering considerations, worker and public health and safety, and public, agency and tribal comments, DOE has decided to implement the preferred alternative evaluated in the FEIS with two modifications and is documenting that decision in this ROD. The preferred alternative consists of removing the SNF from the basins, vacuum drying, conditioning and sealing the SNF in inert-gas filled canisters for dry vault storage in a new facility, to be built at Hanford, for up to 40 years pending decisions on ultimate disposition. The K Basins will continue to be operated during the period over which the preferred alternative is implemented. The preferred alternative also includes transfer of the basin sludge to Hanford's double-shell tanks for management, disposal of non-SNF basin debris in a low-level burial ground at the Hanford Site, disposition of the basin water, and deactivation of the basins pending decommissioning. The two modifications in the ROD are with respect to management of the sludge, and the timing of placement of the SNF into the transportation casks. The modification for management of the sludge is that should it not be possible to put the sludge into the double-shell tanks, the sludge will either continue to be managed as SNF, or disposed of as solid waste. The modification regarding placement of the SNF into the transportation casks would reduce the radiation exposure to the workers by placing the multicanister overpacks (MCOs) inside the transportation casks before the SNF is loaded into the MCOs, instead of loading the SNF into the MCOs prior to placing them inside the transportation casks.

ADDRESSES AND FURTHER INFORMATION: Requests for copies of the

FEIS and for further information on the FEIS or ROD should be directed to: Dr. Phillip G. Loscoe, U.S. Department of Energy, P.O. Box 550, M/S S7-41, Richland, Washington 99352-0550. Dr. Loscoe may be contacted by telephone at (509) 376-7434 or at (800) 321-2008.

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For further information on the DOE NEPA process please contact: Ms. Carol Borgstrom, Director, Office of NEPA Policy and Assistance (EH-42), U.S. Department of Energy, 1000 Independence Avenue SW., Washington, D.C. 20585-0002. Ms. Borgstrom may be reached by telephone at (202) 586-4600 or leave a message at (800) 472-2756.

SUPPLEMENTARY INFORMATION:

Background

This ROD was prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR Parts 1500-1508), and DOE's NEPA Implementing Procedures (10 CFR Part 1021). The ROD is based on the analysis of environmental impacts identified in the FEIS, consideration of project costs, compliance requirements, engineering considerations, worker and public health and safety, and public, agency and tribal comments.

This ROD covers the management of approximately 2,100 metric tons (2,300 tons) of U.S. Government-owned SNF stored in the KE and KW storage basins at DOE's Hanford Site (about 80% of DOE's total inventory). Most of the SNF is from the N Reactor at Hanford, which operated from December 1963 until January 1987 producing materials for the U.S. national defense program and also producing steam that was used for generation of electricity. This SNF consists primarily of metallic uranium, but also contains about five metric tons (six tons) of plutonium and about one metric ton (1.1 ton) of radioactive fission products within the uranium fuel elements.

The KE and KW storage basins are concrete basins constructed in 1951 to temporarily store SNF from the adjacent KE and KW Reactors (nominally 0.5 to 1.5 years prior to reprocessing). The basins are located in the 100-K Area at the Hanford Site about 420 m (1,400 ft) from the Columbia River. The volume of each basin is about 4,900 m^3 (1.3 M gallons) and each basin is filled to about 93% of capacity with water. The water level in each basin is maintained at a depth of about 5 m (16 ft) to absorb heat from the radioactive decay of the fuel rods and to provide a radiation shield for protection of facility workers. SNF from the N Reactor has been stored in the KE Basin since 1975 and the KW Basin since 1981.

Prior to receiving N Reactor SNF the KW Basin was drained, cleaned and refurbished. The bare concrete surfaces were given an epoxy coating which helps keep radioactive elements such as cesium-137 from being absorbed into the concrete. The KW Basin has remained relatively clean because of this refurbishment and also because only sealed canisters of SNF have been stored there. The KE Basin did not receive refurbishment prior to receiving N Reactor SNF. In addition, the SNF in the KE Basin is in open

canisters which allows water to come in contact with the fuel elements inside the canisters.

The principal environmental and safety concerns are associated with the KE Basin and arise from the presence of broken and corroding SNF, buildup of radioactive sludge on the bottom of the basin, deteriorating concrete with vulnerability to earthquake damage, leakage of contaminated water to the soil below the basin, and the presence of cesium-137 contamination of the concrete at the water line which, unshielded, can contribute to worker exposure to radiation. Conditions in KW Basin are not as serious because the SNF stored there is in sealed canisters.

In a November 1993 report entitled ``Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel and other Reactor Irradiated Nuclear Materials and their Environmental, Safety, and Health Vulnerabilities,'' DOE identified K Basins storage problems as requiring priority attention. Similarly, the Defense Nuclear Facilities Safety Board in its recommendation 94-1 to the Secretary of Energy dated May 26, 1994, recommended ``That the [DOE's] program be accelerated to place the deteriorating reactor fuel in the KE Basin at Hanford in a stable configuration for interim storage until an option for ultimate disposition is chosen. This program needs to be directed toward storage methods that will minimize further deterioration.''

Purpose and Need

The purpose of and need for DOE's action to which this ROD applies is to reduce risks to human health and the environment, specifically (1) to prevent the release of radioactive materials into the air or the soil surrounding the K Basins and the potential migration of radionuclides through the soil column to the nearby Columbia River, (2) to reduce occupational radiation exposure, and (3) to eliminate the risks to the public and to workers from the deterioration of SNF in the K Basins.

Alternatives Considered

Preferred Alternative

The preferred alternative is referred to in the FEIS as ``drying/passivation (conditioning) with dry vault storage''. In addition to construction of a staging/storage building at the Canister Storage Building (CSB) site, the proposed series of operations to achieve the preferred alternative is presented below. The details of the processes and perhaps their order are expected to change somewhat as the designs evolve and as the results of ongoing testing become available. However, the impacts of the following steps bound those necessary to place the K Basins SNF in safe dry storage:

- continue K Basin operations until the removal of SNF, sludge and debris, and disposition of the water is completed. Make modifications to the K Basins, as necessary, for maintenance, monitoring and safety, and provide systems necessary to support the activities described below
- remove K Basin SNF from existing canisters, clean and desludge
- repackage the SNF into fuel baskets designed for multi-canister overpack (MCO) dimensions, that would include provision for water removal, SNF conditioning requirements, and criticality control
- after loading SNF into the MCOs and draining the MCOs, dry the SNF under vacuum at approximately 50 °C (120 °F), flood the MCOs with inert gas, seal penetrations, and place in transportation casks
- transport the SNF (in MCOs) in these casks via truck to

the Canister Storage Building (CSB) site in the 200 East Area, and provide for temporary vented staging, as necessary

· further condition the SNF in MCOs, as soon as practicable, heating the SNF in a vacuum to about 300 °C (570 °F) to remove water that is chemically bound to the SNF and canister corrosion products, and to dissociate, to the extent practicable, any reactive uranium hydride present.

· following conditioning, weld-seal the SNF in an inert gas in the MCOs for dry interim storage in a vault for up to 40 years (a storage period of 40 years was used in estimating impacts)

· collect and remove the sludge from the basins and disposition as waste in Hanford's double-shell tanks

· collect the non-SNF debris from the basins and dispose of as low-level waste in Hanford's existing low-level waste burial grounds

· remove and transport basin water to the 200 Area Effluent Treatment Facility

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for disposal at the 200 Area State-Approved Land Disposal Site.

· prepare the K Basins for deactivation and transfer to decontamination and decommissioning program

Principal advantages of the drying/passivation (conditioning) with dry vault storage alternative are that it would accelerate removal of SNF from aging facilities in proximity to the Columbia River, would result in passive vault storage of dry SNF requiring only minimal surveillance, would retard continued degradation of the SNF and would reduce or eliminate reactive uranium hydrides in the SNF.

Principal disadvantages of this alternative are that the construction of new facilities would be required, and some uncertainty exists in the chemical state of the SNF and sludge and, therefore, in the extent to which drying and passivation processes would be required. However, defense-in-depth measures will be engineered to assure safety of the process. Moreover, characterization of K Basins SNF is presently being conducted to address these uncertainties which may result in a more cost-effective conditioning process.

Other Alternatives Considered

The FEIS analyzed six other alternatives for the management of SNF from the K Basins at the Hanford Site. The other alternatives examined in detail were:

· No action alternative: Under this alternative DOE would continue SNF storage in the KE and KW Basins for up to 40 years with no modifications except for maintenance, monitoring, and ongoing safety upgrades. Consideration of the no action alternative is required by CEQ regulation [40 CFR 1502.14(d)].

The principal advantage of the no action alternative is that it would require no movement of SNF and no construction of new facilities.

Principal disadvantages of this alternative are that the K Basins were not designed for an 80-year life (40 years to date and up to an additional 40 years) and would require increasing maintenance of aging facilities with associated potential for increased radiological impacts on workers, would not place the SNF in a safe storage configuration, would not preclude leakage of radionuclides to the soil beneath the basins and near the

Columbia River, and would fail to alleviate concerns expressed by regulatory agencies, advisory bodies and the public relative to environmental impacts induced by seismic events.

· Enhanced K Basins storage alternative: Under this alternative DOE would perform facility life extension upgrades for KW Basin, containerize KE Basin SNF and sludge, and consolidate with KW Basin SNF for up to 40-year storage.

Principal advantages of the enhanced K Basins storage alternative are that it would remove degrading SNF from the KE Basin, permit deactivation of the KE Basin, and would require no construction of new facilities.

Principal disadvantages of this alternative are that the KW Basin was not designed for an 80-year life and would require increasing maintenance of the aging facility. Despite completion of practical upgrades, this alternative would not arrest continued fuel degradation, might result in conditions favorable to the production of reactive uranium hydrides in the repackaged KE Basin SNF transferred to the KW Basin, and would fail to alleviate concerns expressed by regulatory agencies, advisory bodies and the public relative to environmental impacts potentially induced by seismic events.

· New wet storage alternative: Under this alternative DOE would remove SNF from the K Basins and provide for up to 40 years of new wet storage in a new facility located on the 200 Areas plateau that meets current design criteria.

Principal advantages of the new wet storage alternative are that it would accelerate removal of SNF from aging facilities in the proximity to the Columbia River, would make use of a proven storage technology (at least for commercial fuel) coupled with design to modern seismic criteria, and would maintain flexibility for preparing SNF for ultimate disposition.

Principal disadvantages of this alternative are that it would require construction expense and continued maintenance, would not prevent the continuation of SNF degradation, and would not eliminate the potential for further hydriding of the SNF.

· Calcination with dry storage: Under this alternative DOE would remove SNF from the K Basins, calcine it, and provide for up to 40-year dry storage of SNF-oxides in a new cask or vault facility.

The principal advantages of the calcination with dry storage alternative are that it would remove the SNF from aging facilities near the Columbia River and that it would convert the SNF into stable oxides, which are readily storable in a dry form and may be suitable without further processing for ultimate disposal in a geologic repository.

The principal disadvantage of this alternative is the need to construct and operate a relatively expensive calcining facility.

· Onsite processing: Under this alternative the DOE would remove and chemically process K Basins SNF and provide for up to 40-year dry storage of the recovered uranium (as uranium trioxide) and plutonium (as plutonium dioxide), and manage fission product waste in tanks with other wastes under Hanford's Tank Waste Remediation System program.

Principal advantages of the onsite processing alternative are that it would remove the SNF from aging facilities near the Columbia River, convert uranium (the major constituent of SNF) into uranium trioxide that is readily storable in dry form and for which future use (constituent of power reactor fuel) might be found, convert plutonium to a stable oxide for which a future use (constituent of power reactor fuel) might be found or for which storage in a geologic repository may be suitable without further processing, and convert fission products into a form suitable for storage in a geologic repository.

Principal disadvantages of this alternative are the need to construct and operate a relatively expensive separations

facility, the plutonium dioxide product would no longer be self-protecting and would require special storage and accountability that in turn may require construction of additional storage capacity, and no immediate need exists for either the separated uranium or plutonium.

· Foreign processing: Under this alternative, the DOE would remove K Basins SNF, ship overseas for processing, provide for up to 40-year dry storage of returned uranium (as uranium trioxide) and plutonium (as plutonium dioxide), and store vitrified fission product waste, pending ultimate disposition.

With the exception that foreign processing would obviate the need for construction of additional processing facilities at Hanford, the principal advantages of the foreign processing alternative are essentially the same as those for onsite processing.

Principal disadvantages of the foreign processing alternative are the need to transport the K Basins SNF to a U.S. shipping/receiving port, transload the SNF to ocean vessels, ship the SNF to a foreign port, transport the SNF to an operating reprocessing plant, and ship the uranium and plutonium products and vitrified high-level waste back to Hanford or elsewhere, as appropriate. Additional disadvantages include issues associated with the U.S. nuclear nonproliferation policy, unfavorable agency and public opinion regarding

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shipping the degraded fuel off the Hanford Site, costs of new shipping casks, and construction of a new head-end facility at the processing plant. The need for special storage for plutonium product would be the same as in the onsite processing alternative.

In all but the no action alternative, sludge, debris, and contaminated water would be removed from the basins and managed appropriately.

DOE considered, but did not analyze in detail, four additional alternatives identified during the public scoping process. DOE determined that these alternatives were not reasonable in the sense of satisfying the purpose and need for this action. These alternatives, which involved relocation of the K Basins SNF to existing facilities that were in most cases adjacent to the Columbia River, would not meet the Department's objectives of expeditious removal of K Basins SNF and management of the SNF at a location away from the Columbia river.

Comments Received

DOE received comments on the draft EIS from six individuals and representatives of BNFL, Inc., the State of Washington Department of Fish and Wildlife, the State of Washington Department of Ecology, the Oregon Department of Energy, the Nez Perce Tribe, the U.S. Environmental Protection Agency (EPA) and the U.S. Department of the Interior (DOI).

Responses to individual comments are provided in the FEIS (which consists of the draft EIS and an Addendum to the draft EIS). Reproductions of the as-received comment letters and the transcript of oral comments received are presented in Appendix A to the FEIS. Comments from EPA and DOI were received after the close of the public comment period and publication of the FEIS; these comments and DOE's responses will be made available in the public reading rooms listed in the FEIS.

Several representative comments and DOE's responses are paraphrased

below.

Comment. Some commentors voiced concern about the pyrophoricity of the SNF, the potential for ignition and sustained combustion, and the potential for releases of radionuclides to the atmosphere.

Response. The concern for uncertainties in the potential for ignition of SNF is one of the principal drivers for both the DOE's defense-in-depth approach, which includes conditioning of the SNF followed by dry vault storage in sealed, inert-gas filled canisters, and the SNF characterization effort which is currently underway. The characterization work is intended to confirm the efficacy of planned process steps to assure safe SNF management via laboratory analyses of samples of the K Basins SNF.

Comment. Some commentors contended that SNF as packaged would not meet geologic repository requirements, hence the SNF should be processed so that the SNF and high-activity fission products could be put in a form acceptable to repository disposal.

Response. Acceptance criteria for the proposed geologic repository have not yet been determined. In the absence of the criteria for accepting defense SNF or high-level waste into the repository, it is not prudent to base currently needed SNF management decisions too heavily on the criterion of suitability for ultimate geologic disposition.

Comment. The EPA expressed concern that estimates of some accident probabilities were given without describing how the probabilities were derived.

Response. Except in a few instances, such as crane drops, there is no actual experience on which to base estimates of the probability of occurrence of accidents in SNF management as presented in the EIS. As a consequence, engineering judgement is used to qualitatively assess the likelihood of a postulated accident occurring. These qualitative judgments are then expressed as a numerical range of annual frequency of occurrence to permit development of some quantitative estimate of accident impacts that may be compared among the alternatives. While imprecise, these estimates represent the best information available to DOE at this time.

Comment. DOI acknowledged that radiological and nonradiological exposure risks to humans and consideration for special habitats occurring on the Hanford Site were addressed, but expressed concern that environmental impacts in terms of other biota were not addressed in the EIS and thus comparison among alternatives was not complete.

Response. As may be noted in the EIS, impacts on humans (including onsite noninvolved workers, which may be taken as representative of other onsite biota) from normal operations associated with any alternative were estimated to be very small. As a consequence, exposures to other biota and the consequences therefrom are also believed to be trivial to very small. Thus, while zero impact to other onsite biota cannot be claimed, scrutiny of environmental impacts to levels expressed by DOI is believed to be of minimal value in forming a basis for making decisions among the alternatives.

Comment. EPA noted that contrary to Section 6.10 of the draft EIS, DOE must apply for permission to construct any facility, regardless of emission projections expressed in Appendix D of the regulation.

Response. It is DOE's intent to comply with the letter and spirit of all applicable environmental requirements, and DOE will file for permission to construct the facilities associated with the preferred alternative. Although, as indicated by EPA, the requirement was misstated in Section 6.10, the requirement and intent to comply was correctly stated elsewhere in the EIS.

Comment. DOI commented that DOE should provide compensatory mitigation for habitat lost in the initial development of the

canister storage building site.

Response. DOE does not plan to provide mitigation for the CSB site per se. However, DOE is committed to implementing the Hanford Biological Resources Management Plan (BRMP) when it is completed. This plan is intended to provide for responsible management of the Hanford ecosystem.

Environmentally Preferred Alternative

CEQ regulations (40 CFR 1505.2) require identification of the environmentally preferred alternative(s). Overall environmental impacts under normal operating conditions were found to be neither large nor to vary markedly among the alternatives. Since the no action alternative would involve the least handling of SNF and require no new facilities, under normal operating conditions it would have the lowest overall impacts. Hence, the no action alternative is the environmentally preferred alternative under normal operating conditions.

However, over the long term, implementation of the no action alternative is not prudent because it does not address the continuing degradation of the SNF, the increasing accumulation of radioactive sludge, the further contamination of the basin water and the unlikely, but not impossible, occurrence of an earthquake releasing substantial quantities of radionuclides to the air, ground and possibly the Columbia River.

Decision

Based on consideration of environmental impacts, costs, compliance requirements, engineering practicability, worker and public health and safety, and on comments received on the draft EIS, DOE will implement the preferred alternative, as described

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above, with two modifications. The preferred alternative will involve removing the SNF from the basins, vacuum drying, conditioning and sealing the SNF in inert-gas filled canisters for dry vault storage for up to 40 years pending decisions on its ultimate disposition. The preferred alternative also calls for transfer of the basin sludge to Hanford's double-shell tanks for management, disposal of non-SNF basin debris in a low-level burial ground at Hanford, disposition of the basin water at the 200 Area State-Approved Land Disposal Site (SALDS), and deactivation of the basins pending decommissioning.

The first modification is with respect to sludge management. In the preferred alternative, sludge is to be dispositioned as waste in Hanford's double-shell tanks. However, while in the basins, the sludge will continue to be managed as spent nuclear fuel. Should it not be possible to put the sludge into the double-shell tanks, the sludge will either continue to be managed and treated as SNF, or grouted and packaged to meet the Solid Waste Burial Ground waste acceptance criteria. The impacts of alternate sludge management were analyzed in the FEIS and are small. By mass the sludge is about 0.5% of the SNF and impacts of continuing to manage the sludge as SNF would be negligible by comparison.

The second modification is with respect to the timing of the placement of the MCOs into the transportation casks. In the preferred alternative, the fuel baskets would be loaded

into the MCO's, then drained and vacuum dried prior to placement in the transportation casks. However, placing the MCOs in the transportation casks prior to loading the fuel baskets into the MCOs will reduce the exposure of the workers to radiation during draining and vacuum drying.

The DOE selected the preferred alternative principally because it will alleviate concerns for protection of workers, public health and safety, and the environment (by expeditious removal of the SNF from the vicinity of the Columbia River), will utilize a partially completed existing facility (the CSB), will have few, if any, impacts on the physical environment (minimal new construction) and will be implemented at a cost on par with or substantially less than that of the other alternatives.

Mitigation

Implementation of the preferred alternative, which is drying/passivation (conditioning) with dry vault storage at the CSB site, is not expected to result in adverse impacts. As a consequence, preparation of a Mitigation Action Plan (10 CFR 1021.331) in the event of adverse impacts is not planned. Nevertheless, DOE is responding to Executive Order 12856 (58 FR 41981) and associated DOE Orders and guidelines by reducing the use of toxic chemicals, improving emergency planning, response and accident notification, and encouraging the development of clean technologies and the testing of innovative pollution prevention technologies. The pollution prevention program at the Hanford Site is formalized in a Hanford Site Waste Minimization and Pollution Prevention Awareness Program Plan. Moreover, DOE aggressively applies the principle of reducing exposure to both radioactive and toxic chemicals to as low as reasonably achievable (ALARA) throughout its operations.

Issued

This Record of Decision for the Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington is issued by the Department of Energy, Richland Operations Office, Richland, Washington on March 4, 1996.

John D. Wagoner,
Manager, DOE Richland Operations Office.

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